

CLAIMS

1. A preform for a photonic band-gap optical fibre waveguide, comprising a stack of parallel, elongate primary elements and elongate secondary elements in which, in the
5 transverse cross section, the primary elements have a largest external dimension and groups of primary elements define interstitial regions, in at least some of which there is or are respectively one or more secondary elements having a largest external dimension which is less than one third of the size of each of the largest external dimensions of the surrounding primary elements.
- 10 2. A preform according to claim 1, wherein at least some of the interstitial regions are defined by groups of fewer than six primary elements.
3. A preform according to either preceding claim, wherein at least some of the interstitial regions are defined by three primary elements.
4. A preform according to any one of the preceding claims, wherein substantially all of the
15 interstitial regions are defined by three primary elements.
5. A preform according to any one of the preceding claims, wherein at least some of the interstitial regions are enclosed by abutting primary elements.
6. A preform according to any one of the preceding claims, wherein substantially all of the interstitial regions are enclosed by abutting primary elements.
- 20 7. A preform according to any one of the preceding claims, wherein each primary element that defines one interstitial region abuts at least one of the one or more secondary elements that is (or are) in that region.
8. A preform according to any one of the preceding claims, wherein the primary elements are non-tessellating.
- 25 9. A preform according to any one of the preceding claims, wherein at least some of the interstitial regions contain plural secondary elements.
10. A preform according to any one of the preceding claims, wherein at least some of the secondary elements are capillaries.
11. A preform according to any one of the preceding claims, wherein at least some of the
30 secondary elements are rods.
12. A preform according to any one of the preceding claims, wherein at least some of the primary elements are capillaries.

13. A preform according to any one of the preceding claims, wherein at least some of the primary elements have a circular cross section.
14. A preform according to any one of the preceding claims, wherein substantially all of the primary elements have the same cross sectional shape.
- 5 15. A preform according to any one of the preceding claims, wherein each interstitial region containing one or more secondary elements contains substantially the same arrangement of one or more secondary elements.
16. A preform according to any one of the preceding claims, wherein substantially all interstitial voids contain one or more secondary elements.
- 10 17. A preform according to any one of the preceding claims, wherein the primary elements each have a similar largest external dimension.
18. A preform according to any one of the preceding claims, wherein at least a portion of the preform comprises a periodic arrangement of primary and secondary elements having a first characteristic pitch.
- 15 19. A preform according to claim 18, wherein the arrangement of primary elements has a second characteristic pitch.
20. A preform according to claim 19, wherein the arrangement of interstitial regions, containing secondary elements, has a third characteristic pitch.
21. A preform according to claim 20, wherein the second and third characteristic pitches are
20 the same.
22. A preform according to claim 20, wherein the third characteristic pitch is larger than the second characteristic pitch.
23. A preform according to any one of the preceding claims, wherein the primary elements form a substantially triangular array.
- 25 24. A preform according to any one of claims 1 to 22, wherein the primary elements form a substantially hexagonal array.
25. A preform according to any one of the preceding claims, wherein, in the transverse cross section, the primary and secondary elongate elements are arranged around a further parallel elongate element, thereby forming a plurality of second interstitial regions between an outer
30 periphery of the further elongate element and the arrangement of first and second elongate elements.
26. A preform according to claim 25, wherein the second interstitial regions remain empty.

27. A preform according to claim 25, wherein at least some of the second interstitial regions contain one or more secondary elements.
28. A preform according to any one of the preceding claims, wherein the arrangement of primary and secondary elongate elements is enclosed, in the transverse cross section, by a large diameter capillary, thereby forming a plurality of third interstitial regions between an inner periphery of the large diameter capillary and the arrangement of primary and secondary elements.
29. A preform according to claim 28, wherein at least some of the third interstitial regions contain one or more secondary elements.
- 10 30. An optical fibre made from a preform as claimed in any one of the preceding claims.
31. An optical fibre according to claim 30, which is a photonic band-gap optical fibre.
32. An optical fibre according to claim 31, which has a minimum loss less than 12dB/km
33. A method of forming a photonic band-gap fibre, comprising the steps of forming a preform according to any one of claims 1 to 29, and heating and drawing the preform, in one or more stages, into the fibre.
- 15 34. A method according to claim 33, comprising the step of arranging primary elements to form interstitial regions and then inserting, in a longitudinal motion, the secondary elements into the interstitial regions.
35. A method according to claim 33, comprising the step of laying discrete layers of primary and secondary elements on to one another to form a stack of primary and secondary elements.
- 20 36. A method according to claim 35, comprising using automated equipment to position primary and secondary elements.